36 that is disposed over it. The dome **36** also functions as a spring to push the post **24** back to a rest or unactivated position. The post **24** rests on or adjacent to the dome **36**. The dome **36** thus provides a tactile response that is desirable with actuation of a mechanical switch.

[**0043**] Typically, the keymat **22** is a structure without apertures through its surface. Instead, the keymat **22** is formed to provide a location for the plurality of keys **20** to be disposed. Thus, each of the plurality of keys **20** is typically a separate component that is joined with or otherwise fused to the keymat **22**. However, this configuration should not be considered limiting, and the keymat **22** can be formed having integral keys **20**. Another alternative would be to eliminate the keymat **22** altogether, wherein individual keys would not have a structure to hold them together.

[**0044**] In **FIG. 2, a** touchpad **26** is disposed directly underneath the keymat **22**. A plurality of apertures **28** are disposed through the touchpad **26** to enable passage of the posts **24** connected to each of the plurality of keys **20**. The structure of the touchpad **26** is a novel aspect of the invention to be described in detail in other figures.

[**0045**] Disposed underneath the touchpad **26** is a switch substrate **30**. The switch substrate **30** is typically a rigid material such as printed circuit board (PCB). **FIG. 2** shows a mechanical switch **32** disposed on the switch substrate **30**. Also shown disposed on the switch substrate **30** is an LED **34** that is adjacent to the mechanical switch **32** and the dome **36**. A plurality of LEDs **34** on the switch substrate provide illumination that is typically seen through the plurality of keys **20**. Accordingly, the key **20** will be transparent or at least translucent to thereby allow the illumination from the LED to be visible therethrough. It should be apparent that at least a portion of the keymat **22** where the key **20** is disposed will also be transparent or translucent for the illumination to be visible.

[**0046**] What is important to recognize in **FIG. 2** is that the key **20** must be capable of easy actuation of a mechanical switch **32** in order for the mobile telephone to be usable. In other words, the touchpad should not interfere with operation of the plurality of keys **20**. But in order to provide touchpad functionality, the touchpad **26** must be located as close to the keymat **22** and the key **20** as possible. In this preferred embodiment, a novel aspect of the invention is that the aperture **28** makes operable the configuration of the keypad **18** shown in **FIG. 2**.

[**0047**] In order to provide touchpad functionality to the mobile telephone, a plurality of keys **20**, posts **24**, corresponding apertures **28** through the touchpad **26**, and mechanical switches **32** are required. These structures are arranged as shown in **FIG. 3**.

[**0048**] **FIG. 3** is a close-up profile cross-sectional view of a portion of the keypad **18**, wherein the key **20** having post **24** is disposed over aperture **28** through the touchpad **26**. The post **24** is adjacent to or even resting on the dome **36**. The switch substrate **30** is shown spaced apart some distance by gap **40** to enable the dome **36** to be actuated by the post **24**.

[**0049**] Another important and novel aspect of the invention is that in order for the illumination provided by the LED **34** to be visible through the key **20** that the intervening substrate of the touchpad **26** must also be transparent or at least translucent. Furthermore, the material used in the touchpad is important for reasons other than illumination.

[**0050**] It is observed that there are methods of illumination available other than LEDs. For example, electroluminescent lighting may be used in mobile telephones. However, it would be necessary to provide the same apertures through the electroluminescent lighting as are through the touchpad. This may be difficult because of the manufacturing methods currently used. However, a plurality of discrete electroluminescent panels might be disposed under the touchpad **26**.

[**0051**] In the presently preferred embodiment, the touchpad being utilized comes from the GLIDESENSOR(™) technology of CIRQUE(™) Corporation. This technology provides a flexible substrate for the sensor grids of the mutually capacitance-sensitive touchpad. The flexible substrate is not only capable of conforming to arcuate surfaces, such as the underside of the keymat **22**, it is also capable of being slight deformed. This is important because when the key **20** is being pressed so that the post **24** depresses the dome **36** and actuates the mechanical switch **32**, the edges **38** of the key **20** will be pressing on and slightly deforming the touchpad **26**. This movement of the touchpad **26** should be minimized in order to reduce damage that might occur to electrodes disposed thereon.

[**0052**] The GLIDESENSOR(™) touchpad **26** provides another capability that is critical to successful operation of the touchpad in the mobile telephone. The touchpad **26** is providing proximity sensing. Proximity sensing is the ability to detect a pointing object on the plurality of keys **20** or the space between the keys. Proximity sensing is thus the ability to detect a pointing object, in this case a finger, without direct contact with a sensing surface of the touchpad **26**.

[**0053**] GLIDESENSOR(™) is uniquely suited to provide this enhanced z-axis proximity sensing capability as described in the co-pending applications. Essentially, the increased dynamic range of the touchpad as provided by the integrated circuit at the heart of the touchpad circuitry. The increased dynamic range is made possible for several underlying reasons such as not having to throw away the smallest measurement bits because a more accurate analog-to-digital (A/D) converter is being used. More specifically, it was determined that the noise within the A/D converter itself was responsible for having to throw away measurement data that could not be considered reliable. Thus, the techniques used for electronic noise reduction within the touchpad circuitry resulted in substantial improvement in performance.

[**0054**] Another factor is an unexpected result which came about as a consequence of the A/D converter.

[**0055**] Specifically, the number of measurement readings or "sampling" taken by the measurement circuitry could be doubled to thereby cause a decrease in the noise of the A/D converter.

[**0056**] Together, the decreased noise of the A/D converter and the two-fold increase in the number of samples of the measurement circuitry have combined to create at least a four-fold increase in accuracy of the touchpad sensing circuitry.

[**0057**] Another factor is that the present invention utilizes mutual capacitance-sensing technology. One particular advantage of this technology is that the electrode grid